IN THE CLAIMS:

1. (Original) A method of characterizing dielectric material in a magnetic head, comprising:

using a probe to measure heat flow through the probe;

controlling a heat flow through the probe to be substantially zero; and

calculating a thermal conductance of dielectric material in the magnetic head.

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2. (Original) The method of claim 1, further comprising:

cooling the magnetic head to a temperature below ambient temperature; and

applying a current to the magnetic head to warm the surface of the magnetic head until the heat flow through the probe is substantially zero.

3. (Original) The method of claim 2, wherein calculating the thermal conductance includes determining the thermal conductance based on the current, an ambient temperature, and a temperature of the magnetic head.

4. (Original) The method of claim 2, wherein the magnetic head includes a giant magnetoresistive sensor sandwiched between the dielectric material, and wherein the current is applied to the giant magnetoresistive sensor.

5. (Original) The method of claim 4, wherein calculating the thermal conductance includes calculating the thermal conductance based on the following relation:

$$K = (I^2R_{gmr})/(T_a-T_b)$$

where K is the thermal conductance, I is the applied current, R_{gmr} is a resistance of the giant magnetoresistive sensor, T_a is an ambient temperature, and T_b is a temperature of the magnetic head.

6. (Original) The method of claim 2, wherein cooling the magnetic head to a temperature below ambient temperature includes using a thermoelectric cooler to cool magnetic shields in the magnetic head.

7. (Original) The method of claim 1, further comprising modeling thermoelectric characteristics of the magnetic head based on the calculated thermal conductance.

8. (Original) The method of claim 7, further comprising controlling cooling of the magnetic head during operation based on the modeling of thermoelectric characteristics of the magnetic head.

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9. (Original) The method of claim 1, wherein the probe comprises:

a probe body;

a probe tip formed on the probe body;

a first temperature sensor positioned at a tip of the probe tip; and

a second temperature sensor positioned at a base of the probe tip.

10. (Original) The method of claim 9, wherein the first temperature sensor and second temperature sensor are used to measure the heat flow through the probe.

11. (Original) A method of controlling thermal operation of a read/write head, comprising:

determining a thermal conductance of the read/write head by controlling heat flow through a probe to be substantially zero;

modeling thermoelectric properties of the read/write head based on the determined thermal conductance; and

controlling thermal operation of the read/write head based on the modeling of the thermoelectric properties.

12. (Original) The method of claim 11, wherein determining a thermal conductance includes:

using the probe to measure heat flow through the probe;

applying a current to the read/write head to maintain the heat flow through the probe at substantially zero; and

determining the thermal conductance of dielectric material in the read/write magnetic head based on the current.

13. (Original) The method of claim 12, wherein applying the current to the read/write head further comprises:

cooling the read/write magnetic head to a temperature below ambient temperature; and

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applying the current to the read/write magnetic head to warm up the surface of the read/write magnetic head until the heat flow through the probe is substantially zero.

14. (Original) The method of claim 1, wherein the read/write head includes a giant magnetoresistive sensor sandwiched between the dielectric material, and wherein the current is applied to the giant magnetoresistive sensor.

15. (Original) The method of claim 14, wherein calculating the thermal conductance includes calculating the thermal conductance based on the following relation:

$$K = (I^2 R_{gmr})/(T_a - T_b)$$

where K is the thermal conductance, I is the applied current, R_{gmr} is a resistance of the giant magnetoresistive sensor, T_a is an ambient temperature, and T_b is a temperature of the read/write head.

16. (Original) The method of claim 13, wherein cooling the read/write magnetic head to a temperature below ambient temperature includes using a thermoelectric cooler to cool magnetic shields in the read/write head.

17. (Original) The method of claim 11, wherein controlling thermal operation of the read/write head includes cooling of the read/write head during operation based on the modeling of thermoelectric characteristics of the read/write head.

18. (Original) The method of claim 17, wherein cooling of the read/write head during operation is controlled to maintain a temperature of the read/write head near the ambient temperature.

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19. (Original) The method of claim 11, wherein the probe comprises:

a probe body;

a probe tip formed on the probe body;

a first temperature sensor positioned at a tip of the probe tip; and

a second temperature sensor positioned at a base of the probe tip.

20. (Original) The method of claim 19, wherein the first temperature sensor and second temperature sensor are used to measure the heat flow through the probe.

21. (Original) An apparatus for characterizing dielectric material in a magnetic head, comprising:

a probe for measuring heat flow through the probe;

means for controlling heat flow through the probe to be substantially zero; and

means for calculating a thermal conductance of dielectric material in the magnetic head.

22. (Original) The apparatus of claim 21, further comprising:

means for cooling the magnetic head to a temperature below ambient temperature; and

means for applying a current to the magnetic head to warm the surface of the magnetic head until the heat flow through the probe is substantially zero.

23. (Original) The apparatus of claim 22, wherein the means for calculating the thermal conductance includes means for determining the thermal conductance based on the current, an ambient temperature, and a temperature of the magnetic head.

24. (Original) The apparatus of claim 22, wherein the magnetic head includes a giant magnetoresistive sensor sandwiched between the dielectric material, and wherein the means for applying a current applies the current to the giant magnetoresistive sensor.

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25. (Original) The apparatus of claim 24, wherein the means for calculating the thermal conductance includes means for calculating the thermal conductance based on the following relation:

$$K = (I^2 R_{gmr})/(T_a - T_b)$$

where K is the thermal conductance, I is the applied current, R_{gmr} is a resistance of the giant magnetoresistive sensor, T_a is an ambient temperature, and T_b is a temperature of the magnetic head.

26. (Original) The apparatus of claim 22, wherein the means for cooling the magnetic head to a temperature below ambient temperature includes a thermoelectric cooler that cools magnetic shields in the magnetic head.

27. (Original) The apparatus of claim 21, further comprising means for modeling thermoelectric characteristics of the magnetic head based on the calculated thermal conductance.

28. (Original) The apparatus of claim 27, further comprising means for controlling cooling of the magnetic head during operation based on the modeling of thermoelectric characteristics of the magnetic head.

29. (Original) The apparatus of claim 21, wherein the probe comprises:

a probe body;

a probe tip formed on the probe body;

a first temperature sensor positioned at a tip of the probe tip; and

a second temperature sensor positioned at a base of the probe tip.

30. (Original) The apparatus of claim 29, wherein the first temperature sensor and second temperature sensor are used to measure the heat flow through the probe.

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31. (Original) A computer program product in a computer readable medium for characterizing dielectric material in a magnetic head, comprising:

first instructions for controlling a probe to measure heat flow through the probe;

second instructions for controlling heat flow through the probe to be substantially zero; and

third instructions for calculating a thermal conductance of dielectric material.

32. (Original) The computer program product of claim 31, further comprising:

fourth instructions for cooling the magnetic head to a temperature below ambient temperature; and

fifth instructions for applying a current to the magnetic head to warm up the surface of the magnetic head until the heat flow through the probe is substantially zero.

33. (Original) The computer program product of claim 32, wherein the third instructions for calculating the thermal conductance includes instructions for determining the thermal conductance based on the current, an ambient temperature, and a temperature of the magnetic head.

34. (Original) The computer program product of claim 32, wherein the magnetic head includes a giant magnetoresistive sensor sandwiched between the dielectric material, and wherein the second instructions for applying the current applies the current to the giant magnetoresistive sensor.

35. (Original) The computer program product of claim 34, wherein the third instructions for calculating the thermal conductance includes instructions for calculating the thermal conductance based on the following relation:

$$K = (I^2 R_{gmr})/(T_a - T_b)$$

where K is the thermal conductance, I is the applied current, R_{gmr} is a resistance of the giant magnetoresistive sensor, T_a is an ambient temperature, and T_b is a temperature of the magnetic head.

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36. (Original) The computer program product of claim 32, wherein the fourth instructions for cooling the magnetic head to a temperature below ambient temperature includes instructions for controlling a thermoelectric cooler to cool magnetic shields in the magnetic head.

37. (Original) The computer program product of claim 31, further comprising fourth instructions for modeling thermoelectric characteristics of the magnetic head based on the calculated thermal conductance.

38. (Original) The computer program product of claim 37, further comprising fifth instructions for controlling cooling of the magnetic head during operation based on the modeling of thermoelectric characteristics of the magnetic head.

39. (Original) The method of claim 1, further comprising determining a signal to noise ratio of a GMR sensor of the magnetic head based on the thermal conductance of the dielectric material.

40. (Original) The method of claim 39, further comprising determining a maximum bandwidth of the GMR sensor based on the signal to noise ratio.

41. (Original) The apparatus of claim 21, further comprising means for determining a signal to noise ratio of a GMR sensor of the magnetic head based on the thermal conductance of the dielectric material.

42. (Original) The apparatus of claim 41, further comprising means for determining a maximum bandwidth of the GMR sensor based on the signal to noise ratio.

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43. (Original) The computer program product of claim 31, further comprising fourth instructions for determining a signal to noise ratio of a GMR sensor of the magnetic head based on the thermal conductance of the dielectric material.

44. (Original) The computer program product of claim 43, further comprising fifth instructions for determining a maximum bandwidth of the GMR sensor based on the signal to noise ratio.